



Demonstration and assessment of laser heterodyne radiometry for CO₂ sounding

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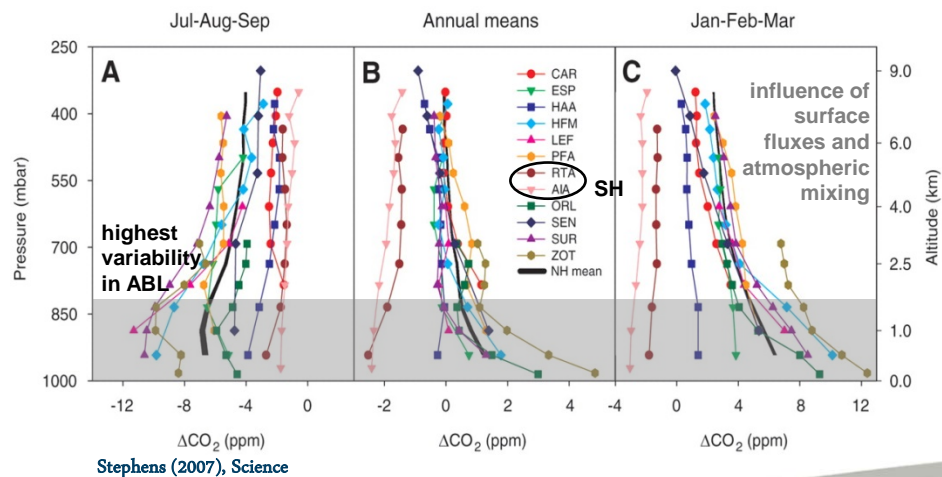
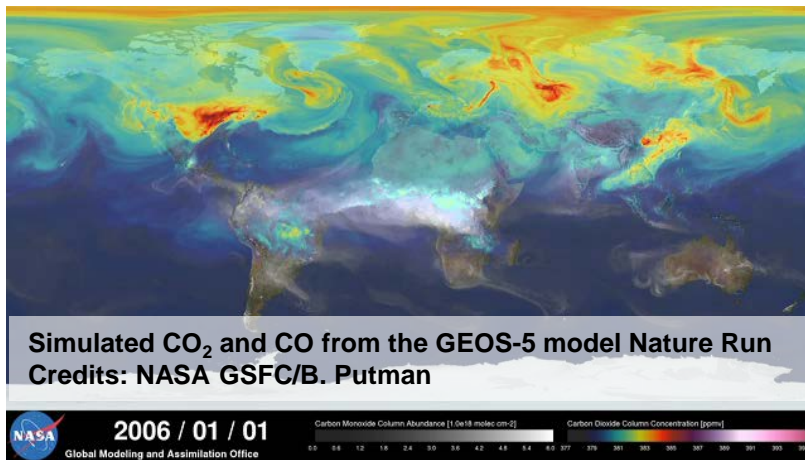
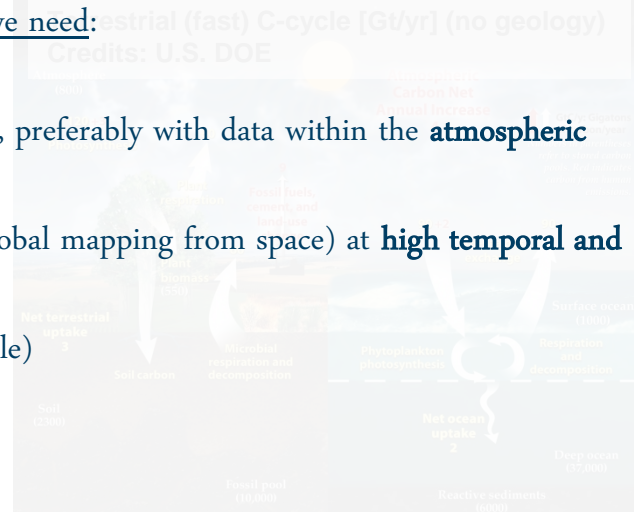
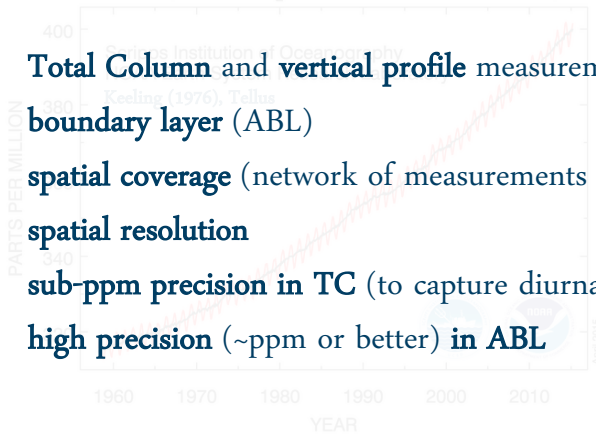
RAL Space Laser Spectroscopy Group

Scientific rationale

... and translation into measurement requirements

For Carbon cycle studies and emission monitoring, we need:

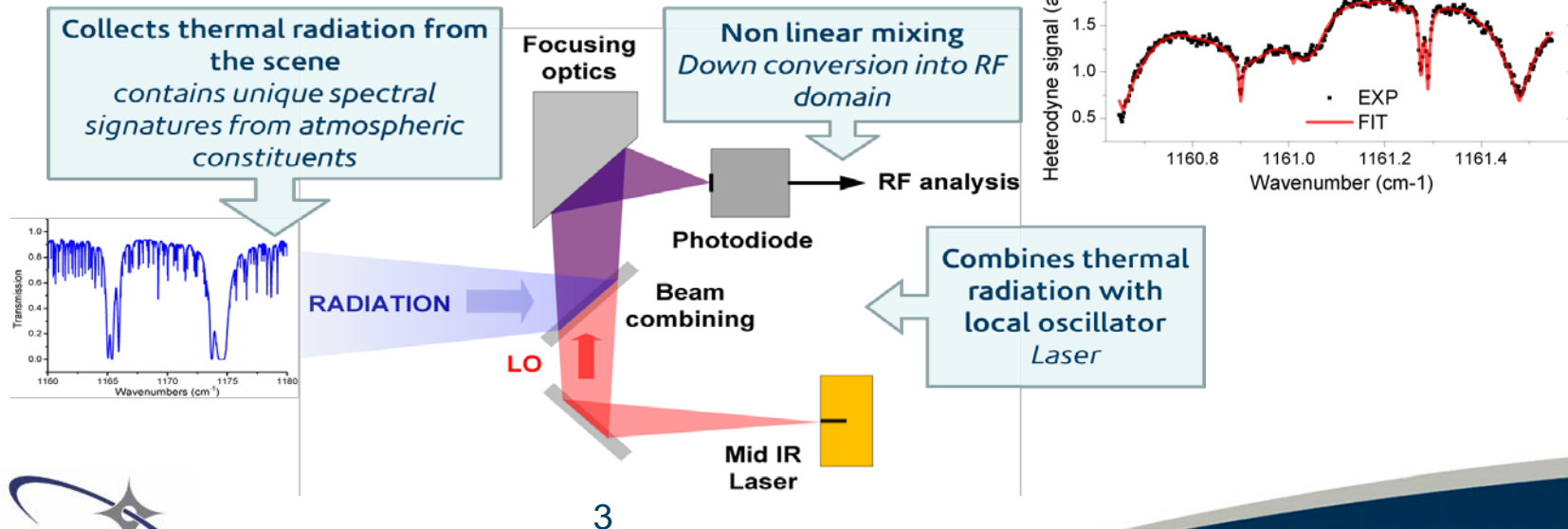
- **Total Column** and **vertical profile** measurements, preferably with data within the **atmospheric boundary layer** (ABL)
- **spatial coverage** (network of measurements or global mapping from space) at **high temporal and spatial resolution**
- **sub-ppm precision in TC** (to capture diurnal cycle)
- **high precision (~ppm or better) in ABL**



Our approach: LHR

What is a Laser Heterodyne Radiometer?

- A PASSIVE thermal infrared sounder
 - Even though there is a laser in it
- A SPECTRO-radiometer
 - Observes the unique spectral signatures of chemicals in the atmosphere
- A new RS technology enabled by advances in semiconductor mid-IR lasers
 - Never deployed in space so far
 - No scattering

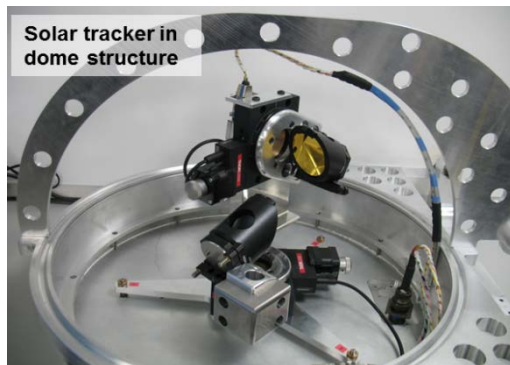


Instrument design and performance

Some advantages of Laser Heterodyne Radiometry

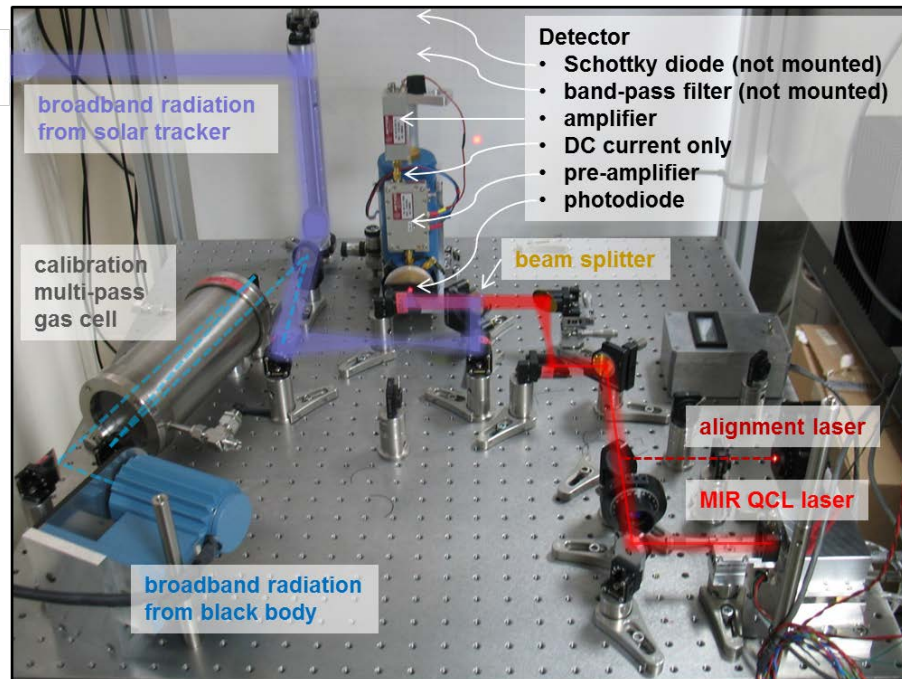
tracking:

small FoV, compact optics, high SNR



detecting in RF domain:

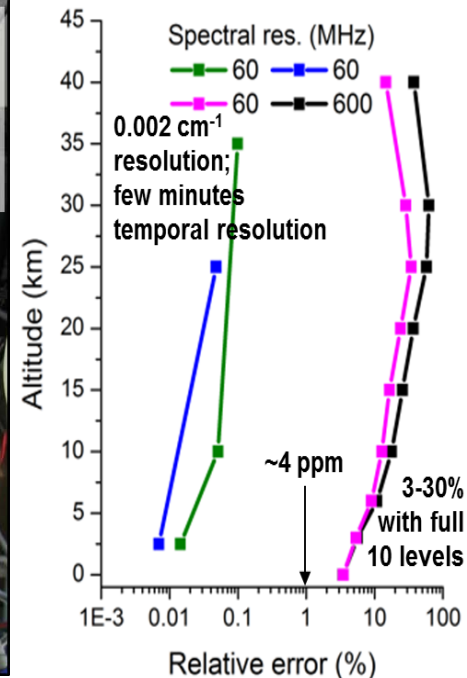
high spectral resolution, good altitudinal information



trading performance:

precision and

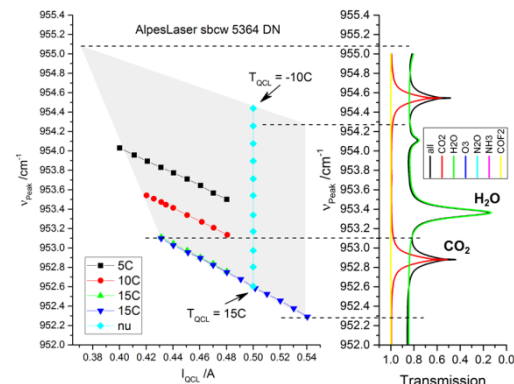
vertical resolution



tuning over microwindow:

little interference,

fast integration



⇒ validate instrument performance model